

An aerial photograph of the Oroville Dam and its reservoir. The dam is a large concrete structure spanning a wide river. The reservoir is a large body of blue water. The surrounding landscape is a mix of dry, brownish-yellow hills and green, forested areas. A winding road is visible on the left side of the image. The text is overlaid on the upper right portion of the image.

# **Oroville FERC Relicensing (Project No. 2100)**

**Environmental Work Group**

**August 25, 2004**

**SP-F3.1 Task 4C Final Report**

# Evaluation of Water Surface Fluctuations on Bass Nest Dewatering and Characterization of Inundated Littoral Habitat in the Thermalito Afterbay

## SP-F3.1 Task 4C Final Report



# Need for Study/ Study Objectives

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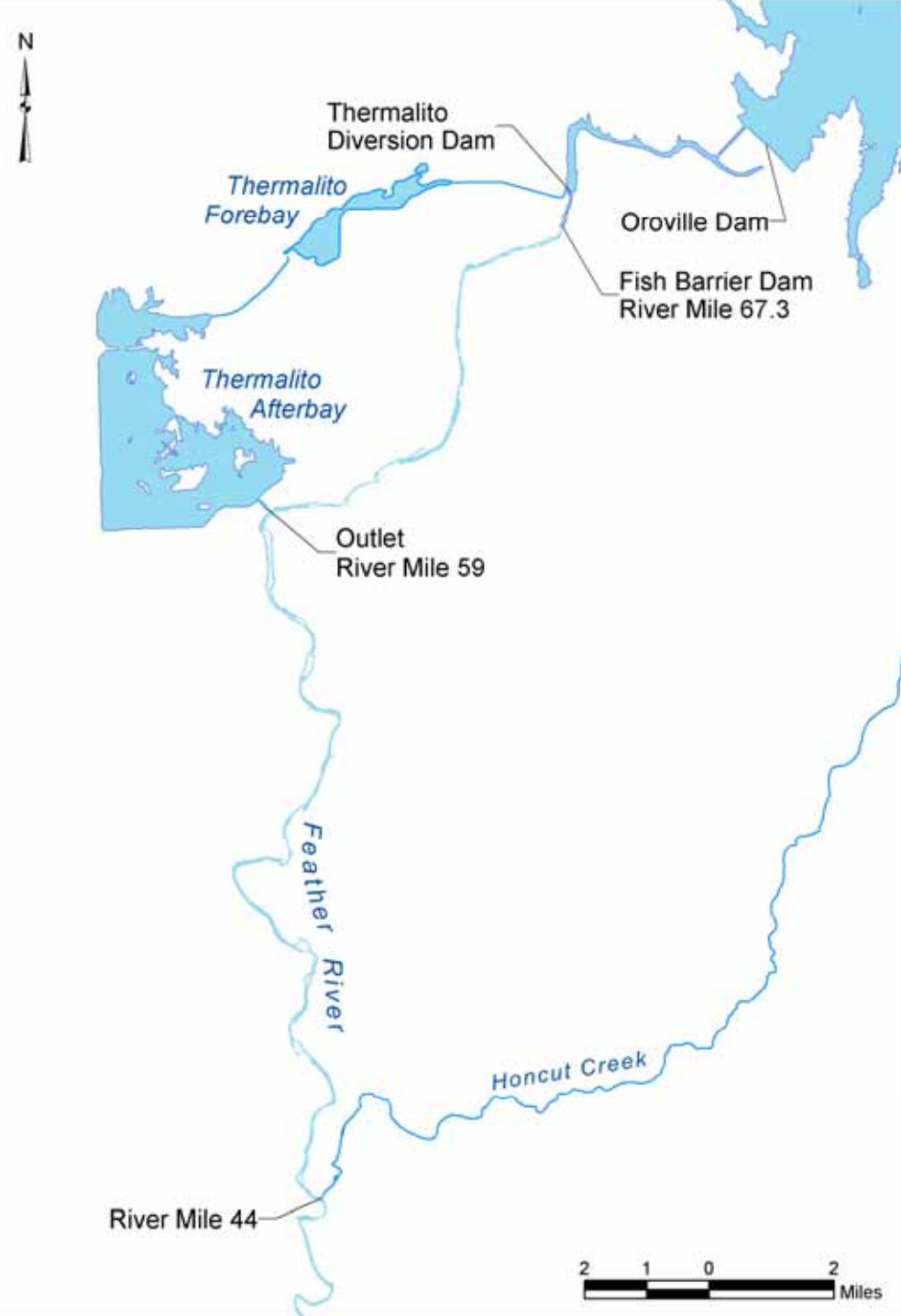
- ◆ **The Oroville Facilities affect Thermalito Afterbay water surface elevation, thereby influencing:**
  - ◆ **Potential for black bass nest dewatering, and**
  - ◆ **Availability of inundated littoral habitat for black bass juvenile rearing**



# Introduction

## Study Area

- ◆ **Thermalito Afterbay**
  - ◆ Shallow off-channel reservoir
  - ◆ Maximum surface area – 4,300 acres
  - ◆ Maximum water surface elevation - 136.5 ft msl
  - ◆ Minimum observed water surface elevation – 124 ft msl



# Introduction

## Operational Constraints

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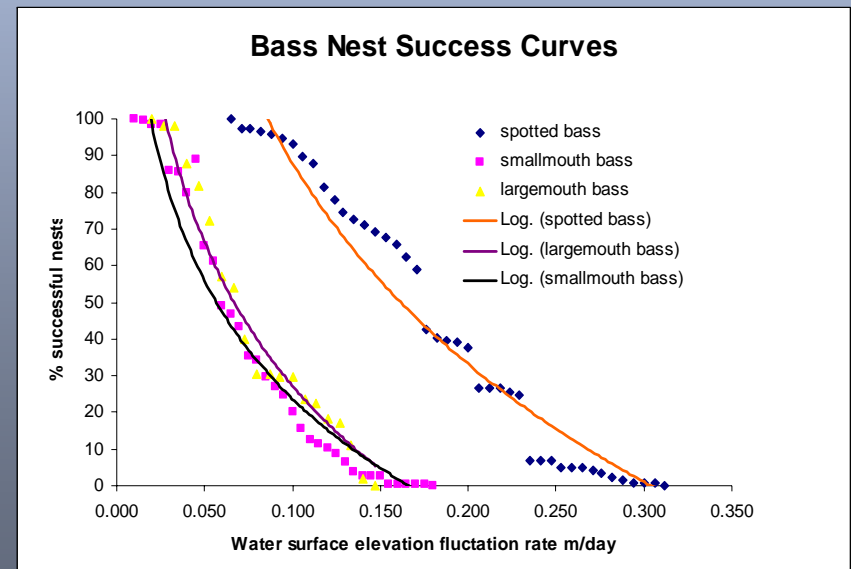
- ◆ **Reservoir Fluctuations**
  - ◆ Daily and weekly fluctuation cycles
  - ◆ Peaking and pumpback operations
  - ◆ Agricultural diversions
  - ◆ Thermalito Afterbay Outlet releases



# Nest Dewatering Methodology

## Conceptual Approach

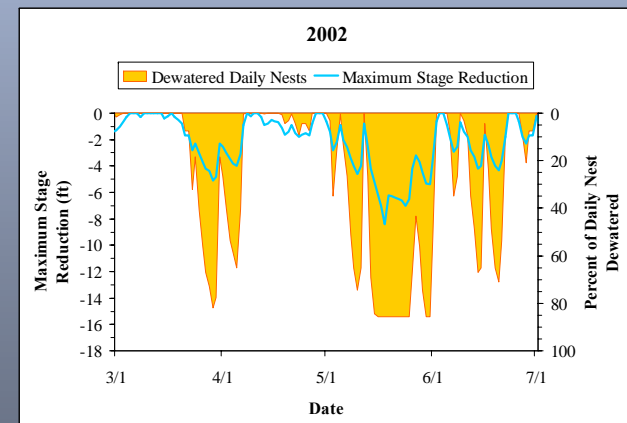
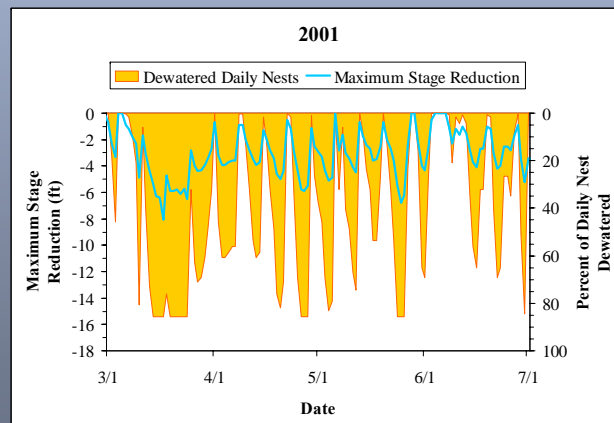
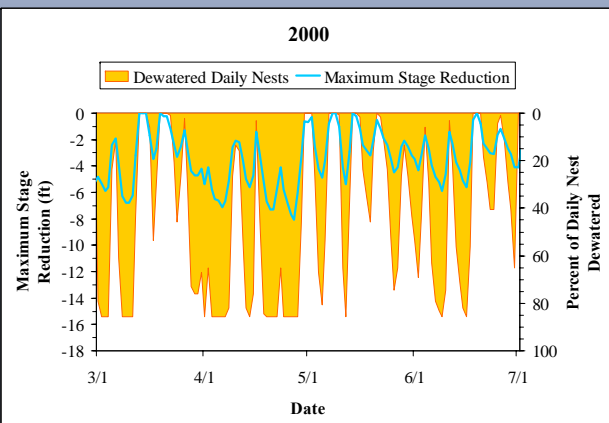
- ◆ Establish a nest success evaluation criterion
  - ◆ Self-sustaining black bass populations in North America experience a nest success (i.e., the nest produces swim-up fry) rate of 60 percent
- ◆ Apply the 60% nest success level to species-specific relationships between nest success and surface elevation fluctuations to identify species-specific “maximum” stage elevation fluctuation rates



# Nest Dewatering Methodology

## Conceptual Approach

- ◆ Examine the frequency and duration of stage elevation fluctuations that are greater than each species' "maximum" stage elevation fluctuation rate
- ◆ Determine the percentage of nests dewatered during each day of the spawning and incubation period

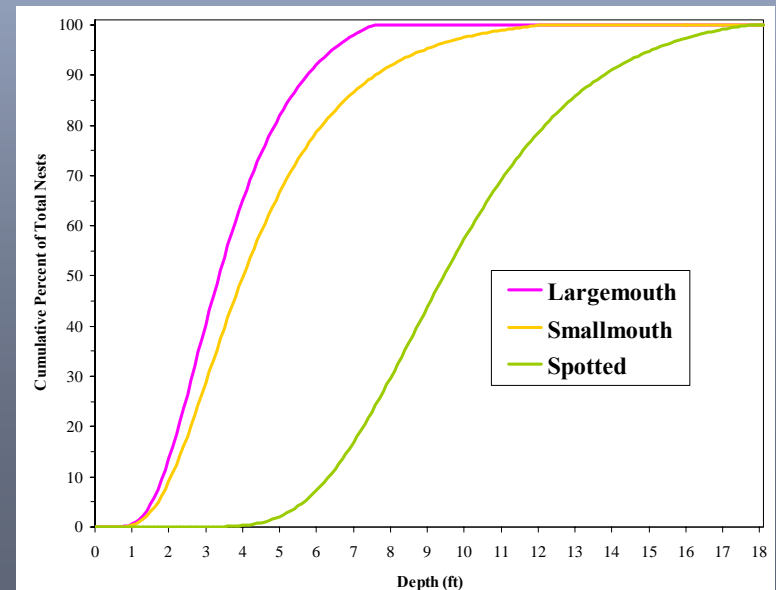
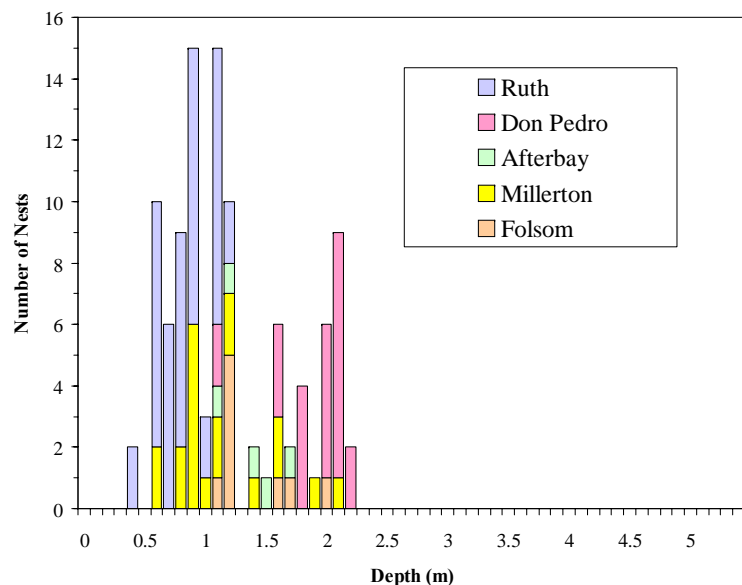


- ◆ Compare the percentage of nests dewatered each day to the nest success criterion

# Nest Dewatering Methodology

## Analytical Procedures

- ◆ **Derive bass nest depth distribution**
  - ◆ 5 largemouth bass nests identified during snorkel and boat surveys conducted in 2003
  - ◆ Lee (1999) presented largemouth bass, smallmouth bass, and spotted bass nest depth data collected from several California reservoirs (5 observations from afterbay were added for analysis)

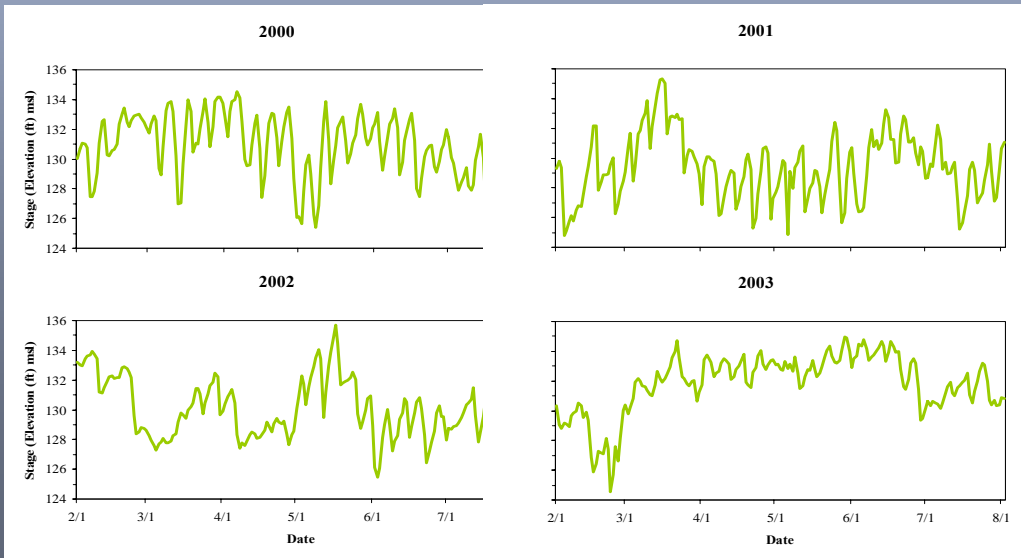
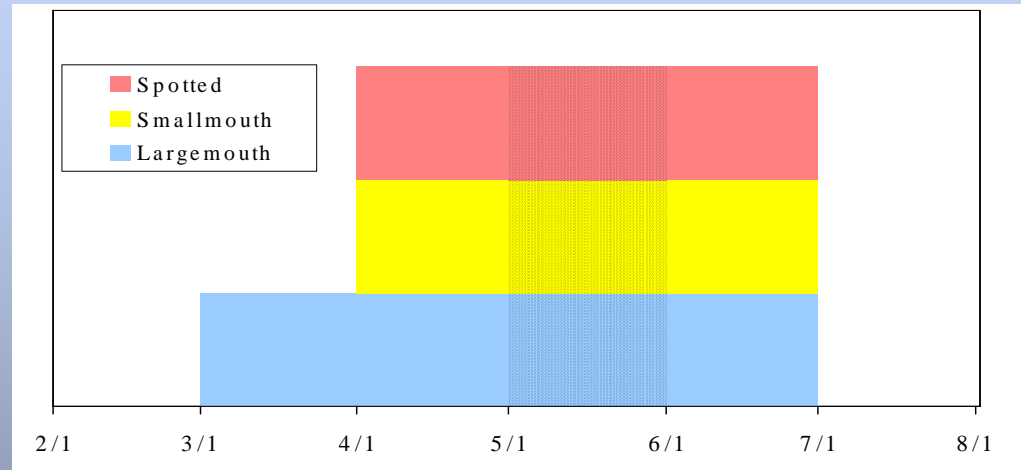




# Nest Dewatering Methodology

## Analytical Procedures

- ◆ **Derive bass spawning timing and incubation duration derived from available literature**
- ◆ **Examine daily changes in stage elevation during spawning and incubation**



# Nest Dewatering Methodology

## Analytical Procedures

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- ◆ Calculate the daily percentage of total nests that would have been dewatered in 2000, 2001, 2002, and 2003
- ◆ Compare the percentage of dewatered nests to the nest success criterion determined from the literature
  - ◆ > 40% dewatering (less than 60% survival) would not allow for a self sustaining population

# Nest Dewatering Results

## Summary

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Percentage of days with more than 40% of bass nests dewatered

YEAR	Largemouth Bass	Smallmouth Bass	Spotted Bass
2000	55.7	52.7	0
2001	49.2	44.0	0
2002	33.6	30.8	0
2003	12.3	16.5	0
Average	37.7	36.0	0

# Littoral Habitat Availability

## Introduction

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- ◆ **Benefits of inundated littoral habitat to bass populations**
  - ◆ **Juveniles can escape predation**
  - ◆ **Aquatic invertebrate production increases, providing an increase in small prey items**
  - ◆ **Black bass recruitment to age-1 has been linked with littoral habitat availability (Aggus and Elliott 1975; Miranda and Pugh 1997)**



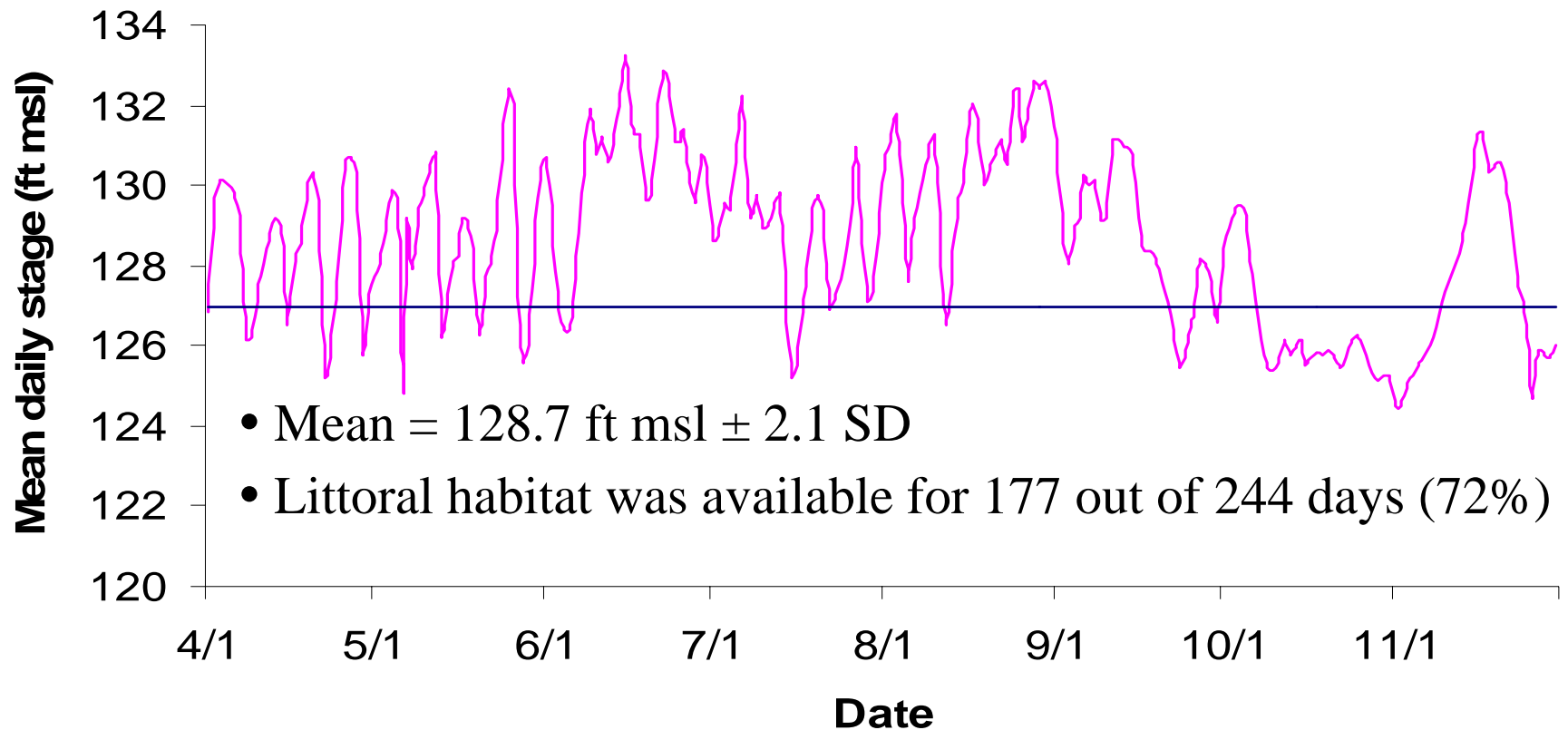
# Littoral Habitat Availability Methodology

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- ◆ Utilize vegetation maps from SP-T4, *Biodiversity, Vegetation Communities, and Wildlife Habitat Mapping*
  - ◆ SP-T4 and personal communications with DWR staff suggest that, in the Thermalito Afterbay, aquatic emergent vegetation occurs at stage elevations  $\geq 127$  ft msl
  - ◆ Thus, stage elevations  $\geq 127$  ft msl provide littoral habitat to rearing bass
- ◆ Habitat mapping occurred in 2001, thus only the 2001 rearing period was analyzed
- ◆ Calculate the percentage of time during the initial rearing period (April through November) that the mean daily stage elevation in the Thermalito Afterbay is  $\geq 127$  ft msl

# Littoral Habitat Availability Results

## Mean Daily Stage Elevation in the Thermalito Afterbay during 2001



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## Conclusions

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- ◆ **Bass Nest Dewatering**

- ◆ The 60% nest survival criterion was not met during a relatively large portion of the spawning and incubation period for largemouth bass and smallmouth bass nests
- ◆ The 60% nest survival criterion was met during the spawning and incubation period for all years analyzed for spotted bass

- ◆ **Littoral Habitat Availability**

- ◆ Black bass juvenile rearing habitat was available for the majority of the rearing period